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		Art Unit	3752
		Examiner Name	C. Kim
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ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
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- [ ] Amendment / Reply
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Crabtree, et al.	
Application No.: 09/593,360	
Filed: 6/14/2000	Art Unit:
Title: (Ranger CIP) System for Automatic Self-Proportioning of Foam Concentrate into Fire Fighting Fluid Variable Flow Conduit	3752
	Examiner:
Attorney Docket No.: 44500	C. Kim

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

REPLY to Examiner's Answer Mailed on 12/16/04

Re Issue 1- Two Corrections

Corrections of Appeal Brief (page 6): Claim 16, in its current form, was not an original claim. Applicant will not rely on claims 24-26 and/or 33-36, since they were added by a preliminary amendment, as pointed out by the Examiner.

Re Issues 2 and 3- Key Clarification

In the Response to Arguments section of the Answer, page 5 lines 1-3, the Examiner states that

> "Appellant's classification/description of **Stage I** (when pin 62 is bottomed out in the downstream end of slot 60) and **Stage II** (the brief transitory period when piston 32 is moved from its closed to its open position or vice versa) is acknowledged." (emphasis supplied)

Then further on page 8, the last page of the Answer, lines 18-20, the Examiner states:

> "Appellant focuses on what appellant describes as **Stage I** in the operation of Klein. **The rejections are based solely on what appellant describes as Stage II in the operation of Klein." (emphasis supplied)**

This is the first time that the Examiner has clarified that the Examiner is relying **solely** on what appellant has named and described as "Stage II" in the Brief, i.e: "the brief transitory period [of Klein] when piston 32 is moved from its closed to its open position, or vice versa." The prior

basis for the rejections was ambiguous. Applicant had had no recourse but to define Stage I and Stage II and then focus on both of them in the Appeal Brief.

NOTE

Stage I is the point and purpose of Klein's invention. Klein himself directs no discussion to Stage II. In fact Klein acts as if "Stage II" does not exist. (See Klein column 7 lines 12-17, i.e.: "The piston return spring 38 is a significantly weak spring so that with <u>any</u> <u>amount</u> of pump flow the displacement limiting pin 62 will <u>always</u> bottom out in the downstream end of the slot 60 and the piston <u>will</u> <u>at</u> <u>all</u> <u>times</u> during pump flow remain fixed in its pre-selected proportioning position.") It is thus understandable that Applicant assumed that the Examiner was significantly relying upon Stage I.

As a consequence of the Examiner's clarification, discussion of **"Issues 2 and 3 Sub-Issue A"** is now unnecessary. Focusing attention now on "he brief transitory opening period," Stage II, Applicant identifies key issues in regard to Sub-Issues B, C, D and E, the Sub-Issues being restated below for convenience.

Issue 2 and 3 – <u>Sub-Issue B</u>: whether Klein discloses:

(1) "**adjusting** a firefighting fluid orifice in a fire fighting fluid conduit **to maintain a predetermined pressure drop** across the orifice as fire fighting fluid flow rate through the conduit varies; " as in claim 12;

(2) "**varying** a fire fighting fluid orifice in a conduit **to maintain a preselected pressure drop** in the conduit", as in claim 14;

(3) "automatically **adjusting** a firefighting nozzle **to control discharge pressure**;" as in claim 20;

(4) "**varying** the obstruction by the pilot valve **to maintain a fixed pressure drop** in the fire fighting fluid conduit", as in claim 39;

(5) "automatically **adjusting** an obstruction in a fire fighting fluid conduit flowing at least 500 gpm **to maintain a preselected pressure drop**", as in claim 42.

Issues 2 and 3 – <u>Sub-Issue C</u>: does Klein teach, suggest or enable **automatically** varying a foam proportioning orifice in order to meter **in accordance with flow rate**, as per claim 20?

Issues 2 and 3 – <u>Sub-Issue D</u>: does Klein teach or suggest **automatically** adjusting… **to control discharge pressure** (or pressure drop), as per claims 20 and 42?

Issues 2 and 3 – Sub-Issue E: does Klein disclose that a varying fire fighting fluid orifice **acts as a fire fighting fluid flow rate indicator**, as per claim 14?

Preliminary Remarks:

There should be no disagreement that Klein addresses no discussion to, nor acknowledgement of, this "brief transitory opening period" which Applicant has labeled Stage II. The Examiner's argument must be characterized as an "inherency" argument.

Applicant submits that the Examiner does not supply a showing of how or why one would "inherently" expect Klein's valve to "proportion" in accordance with "flow rate" in this transitory Stage II, or how or why Klein's valve should "inherently" "maintain" a "predetermined" pressure drop or control discharge pressure of the valve, during this Stage II. Given the nature of the inherency of the Examiner's position, the Examiner should bear the burden of showing how it is necessarily so that each and every "claim limitation" is met. A conclusory assertion to that effect should be deemed inadequate to make the requisite prima facie case. See In re Robertson 169 F.3d 743,745 (Fed Cir 1999). (To establish inherency the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the reference. Inherency may not be established by probabilities or possibilities.) Applicant cannot adequately reply to a conclusory "inherency" assertion that is not based on an evidentiary showing.

Furthermore, one of ordinary skill in the art would anticipate that this brief transitory period is not stable and is turbulent, (see attachment A,) such that fluid pressure on piston 32 and fluid flow rate through the valve and the pressure drop across piston 32 are all likely to be complex, fluctuating and unpredictable.

Notwithstanding, Applicant notes the following. Applicant's claims recite "to maintain a predetermined pressure drop across the orifice" (independent claim 12); "to maintain a pre-selected pressure drop in the conduit" (independent claim 14); "to maintain a fixed pressure drop across the orifice" (independent claim 16); "adjusting a fire fighting nozzle to control discharge pressure" together with "automatically varying a foam proportioning orifice in order to meter foam concentrate self-educted into the nozzle in accordance with fire fighting fluid flow rate through the nozzle" (independent claim 20); to maintain a fixed pressure drop in the fire fighting fluid conduit" (independent claim 39); and "adjusting an obstruction … to maintain a pre-selected pressure drop" (independent claim 42). The Examiner conclusorily asserts, bottom of page 8 and the top of page 9: "No matter how brief the time period for valve 32 of Klein to open, the orifice 18, piston head 16, spring 18 and trapezoidal shaped orifice 54 function automatically to control the pressure drop across the piston head 36 and automatically proportion the chemical through

orifice 54 into the flowing fluid out of orifice 20." In this conclusory assertion the Examiner does not provide any showing of how or why it could be so, i.e. that orifice 18, piston head 36, spring 38 and orifice 54 of Klein's valve function "to maintain a pre-determined pressure drop across the orifice" (claim 12); or "maintain a pre-selected pressure drop in the conduit" (claim 14); "or maintain a fixed pressure drop in the fire fighting fluid conduit" (claim 39); or "maintain a pre-selected pressure drop" (claim 42.) Applicant asserts that such is not so. No predetermined or preselected pressure drop is maintained.

Since the first element of claim 20 is directed to a fire fighting "nozzle" and to automatically adjusting a fire fighting "nozzle" to control "discharge pressure," "discharge pressure" would be the pressure of fluid flowing out of valve orifice 20. The Examiner does not assert or show how Klein's valve elements control the pressure out of orifice 20. The Examiner offers no explanation of how Klein's valve could control discharge pressure in the face of an admitted variation in supply pressure during Stage II. There is further no showing, based upon the asserted "inherency," of how there is "proportioning" of foam concentrate through the valve in accordance with fire fighting fluid flow rate through the valve (as per claim 20).

In regard to "to maintain a predetermined pressure drop across the orifice while the fire fighting fluid flow rate through the conduit varies" the Examiner replies on pages 6 and 7 of the Answer:

> "Klein teaches varying/adjusting orifice 18 using piston 32 and spring 38. Spring 38 by definition has a spring constant. ... Spring 38 like all springs functions according to the relationship F = -k x. Therefore, valve 32 opens distance x according the force of the fluid applied against piston head 36. As fluid pressure increases, from zero to steady state flow, the pressure against valve head increases causing valve head to be displaced from fully closed to an open condition. During that period, no matter how brief, appellant's claim limitation is met."

Applicant cannot follow this argument. The ultimate sentence is ambiguous and does not appear to follow from the foregoing. The Examiner does not explain how Klein's valve, during the brief transitory opening period, can "maintain" a "pre-determined" pressure drop across the orifice. Applicant asserts that it does not.

In contrast to the Examiner's conclusory assertions, the instant specification, to take an instance beginning on page 16 line 9 through page 17 line 17, discloses a "pressure regulating" nozzle. Therein the Applicant discloses how a spring, set for biasing fluid pressure within the baffle chamber, might be set at approximately 65 psi in order to reach a proper balancing of

inward and outward fluid pressure upon forward and backward baffle surfaces in order to achieve a targeted pressure drop of approximately 100 psi. The nozzle of Figures 3A and 3B can maintain a pre-selected pressure drop across the discharge orifice (between baffle head B and bearing head 21.)

Again, to take another instance, the instant specification on page 20 line 10 through page 21 line 9 discloses how to maintain a pre-selected pressure drop in a conduit using an adjustable baffle that adjusts in response to fluid pressure presented to both a forward and a reverse side of a baffle surface. Applicant again discusses, in relation to Figures 11A-C, how to maintain a predetermined pressure drop across an orifice as fire fighting fluid flow rate through a conduit varies. See page 25 line 23 through page 27 line 24. The targeted amount of the pressure drop is set by pilot valve spring SP.

The Examiner has not shown how Klein's orifice 18, piston 32 and spring 38 could so maintain a pre-determined pressure drop across an orifice. The Examiner, by contrast, merely summarily and conclusorily states for Klein that ("inherently") "during that period no matter how brief, appellant's claim limitation is met." Such conclusory assertion cannot be meaningfully addressed or shown erroneous. The Examiner does not offer any explanation how any particular pressure drop is asserted to be maintained.

In regard to claim 39, the Examiner asserts on page 7, first paragraph beginning thereon, that valve head 36 of Klein is arranged sensitive to flow rate by spring 38 during the brief transitory opening period. Neither Klein nor the Examiner teach or discuss how valve head 36 could be sensitive to "flow rate," as opposed to pressure, for instance, in Stage II.

In conclusion, Restricting attention to the brief transitory opening period called Stage II of Klein, and what the Examiner asserts is inherent therein, Applicant submits that the Examiner's showing is inadequate, and that the conclusions are incorrect.

Directing attention solely to Issue 3, whether Klein renders claims 20 and 42 unpatentable as obvious under §103(a), Applicant submits that the Examiner has not provided sufficient evidence of motivation to modify Klein's valve 10 to make it a nozzle. Klein could be said to teach away from such modification. Klein teaches stationing his valve 10 preferably on the suction side of a pump or alternately on the pressure side of a pump. Nozzles are not useful attached to pumps. Nozzles are attached to lines or pipes such that they can be staged proximate their targets. Nozzle discharges are designed to recover head pressure and thus to maximize range. It is unclear whether reworking the outlet of Klein's valve 10 into a suitable outlet to optimize recovery of head or supply pressure, like a nozzle, would destroy the efficient

functioning of the valve. Testing would be required to determine if the modification could be successfully made, and how. The instant application is not to be used as a blueprint. It might be further noted that Klein's valve is capable of, and in fact is taught and designed to be, installed in a fire fighting system to spray mixed fluid. There is no need, therefore, or motivation to "modify" Klein's valve to become a terminal member in order to spray the mixed fluid.

Respectfully Submitted,

2/15/5

Date

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13 FLUID DYNAMICS

13-1 Introduction

Fluid dynamics is the study of fluids in motion. It is one of the most complex branches of mechanics, as illustrated by such familiar examples of fluid flow as a river in flood or a swirling cloud of cigarette smoke. While each drop of water or each smoke particle is governed by Newton's laws of motion, the resulting equations can be exceedingly complex. Fortunately, many situations of practical importance can be represented by idealized models that are simple enough to permit detailed analysis.

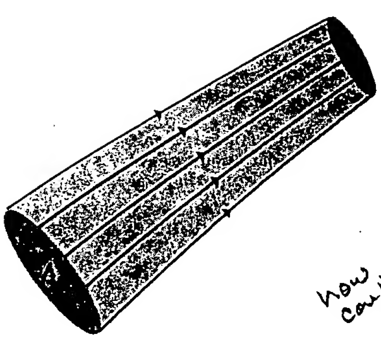
To begin, we shall consider only a so-called *ideal fluid,* that is, one that is incompressible and has no internal friction or viscosity. The assumption of incompressibility is usually a good approximation for liquids. A gas can also be treated as incompressible provided the flow is such that pressure differences are not too great. Internal friction in a fluid gives rise to shear stresses when two adjacent layers of fluid move relative to each other, or when the fluid flows inside a tube or around an obstacle. In some cases these shear forces can be neglected in comparison with gravitational forces and forces arising from pressure differences.

The path followed by an element of a moving fluid is called a *line of flow.* In general, the velocity of the element changes in both magnitude and direction along its line of flow. If every element passing through a given point follows the same line of flow as that of preceding elements, the flow is said to be *steady* or *stationary.* When any given flow is first started, it passes through a nonsteady state, but in many instances the flow becomes steady after a certain period of time has elapsed. In steady flow, the velocity at each point of space remains constant in time, although the velocity of a particular particle of the fluid may change as it moves from one point to another.

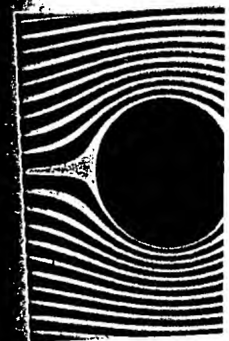
A *streamline* is defined as a curve whose tangent, at any point, is in the direction of the fluid velocity at that point. In steady flow, the streamlines coincide with the lines of flow.

how could it not

If we construct all of the streamlines passing through the periphery of an element of area, such as the area A in Fig. 13-1, these lines enclose



13-1 A flow tube bounded by streamlines.



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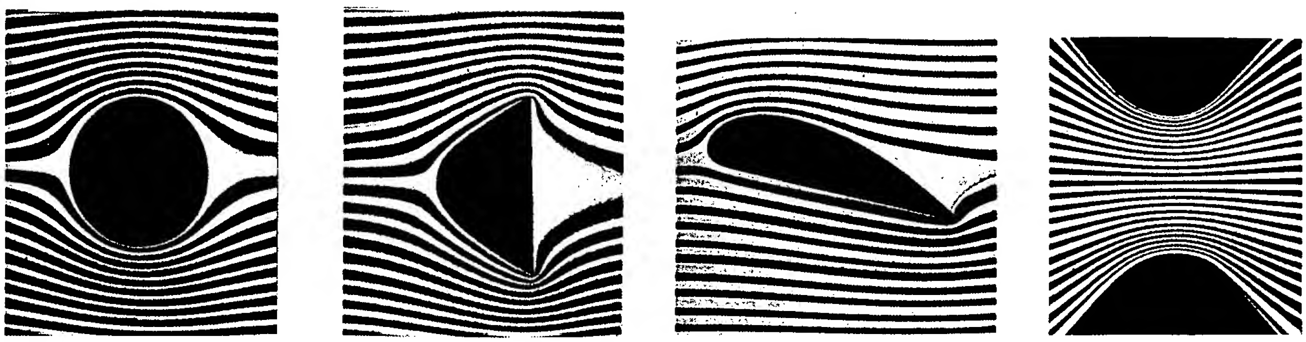


(a) (b) (c) (d)

13-2 (a), (b), (c): Streamline flow around obstacles of various shapes. (d) Flow in a channel of varying cross-sectional area.

a tube called a *flow tube* or *tube of flow*. From the definition of a streamline, no fluid can cross the side walls of a tube of flow; in steady flow there can be no mixing of the fluids in different flow tubes.

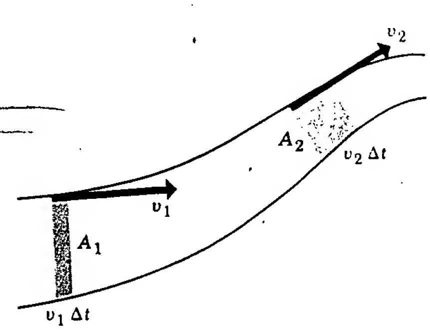
Figure 13-2 illustrates the nature of the flow around a number of obstacles, and in a channel of varying cross section. The photographs were made using an apparatus designed by Pohl, in which alternate streams of clear and colored water flow between two closely spaced glass plates. The obstacles and the channel walls are opaque flat plates that fit between the glass plates. It will be noted that each obstacle is completely surrounded by a tube of flow. The tube splits into two portions at a so-called *stagnation point* on the upstream side of the obstacle. These portions rejoin at a second stagnation point on the downstream side. The velocity at the stagnation points is zero. It will also be noted that the cross sections of all flow tubes decrease at a constriction and increase again when the channel widens.

The patterns of Fig. 13-2 are typical of *streamline* or *laminar* flow, in which adjacent layers of fluid slide smoothly past each other. At sufficiently high flow rates, or when boundary surfaces cause abrupt changes in velocity, the flow becomes irregular and much more complex and is called *turbulent* flow. In turbulent flow there is, strictly speaking, no steady-state pattern, since the flow pattern continuously changes.

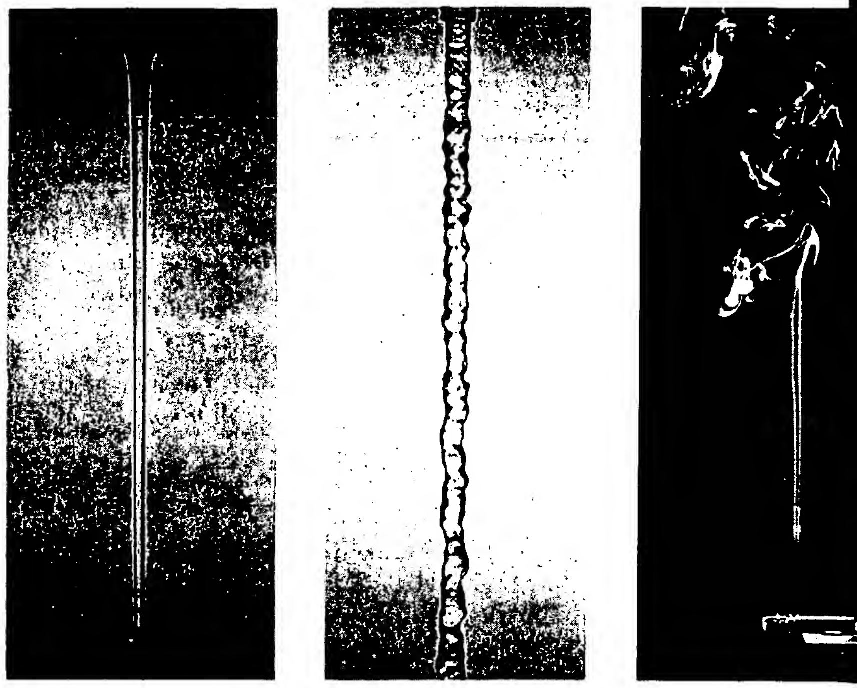
13-2 The equation of continuity

Let us consider any stationary, closed surface in a moving fluid; in general, fluid flows into the volume enclosed by the surface at some points and flows out at other points. The *equation of continuity* is a mathematical statement of the fact that the *net rate of flow of mass inward* across any closed surface is equal to the rate of increase of the mass within the surface.

For an incompressible fluid in steady flow, the equation takes the following form. Figure 13-3 represents a portion of a tube of flow, between two fixed cross sections of areas A_1 and A_2. Let v_1 and v_2 be the speeds at these sections. There is no flow across the side wall of the tube because at every point on the wall the velocity is tangent to the wall. The volume of fluid that flows into the tube across A_1 in a time interval Δt is that contained in the short cylindrical element of base A_1 and height $v_1 \Delta t$, that is, $A_1 v_1 \Delta t$. If the density of the fluid is ρ, the *mass*



13-3 Flow into and out of a portion of a tube of flow.


(a) (b) (c)

13-15 (a) Laminar flow. (b) Turbulent flow. (c) First laminar, then turbulent.

Since this is much less than 3000, the flow would be laminar and would not become turbulent unless the velocity were as great as $420\ \mathrm{cm \cdot s^{-1}}$.

The distinction between laminar and turbulent flow is shown in the photographs of Fig. 13-15. In (a) and (b) the fluid is water and in (c) air and smoke particles.

The Reynolds number of a system forms the basis for the study of the behavior of real systems through the use of small scale models. A common example is the wind tunnel, in which one measures the aerodynamic forces on a scale model of an aircraft wing. The forces on a full-size wing are then deduced from these measurements.

Two systems are said to be *dynamically similar* if the Reynolds number, $\rho v D/\eta$, is the same for both. The letter D may refer, in general, to any dimension of a system, such as the span or chord of an aircraft wing. Thus the flow of a fluid of given density ρ and viscosity η, about a half-scale model, is dynamically similar to that around the full-size object if the velocity v is twice as great.

Questions

13-1 Is the continuity relation, Eq. (13-1), valid for compressible fluids? If not, is there a similar relation that *is* valid?

13-2 If the velocity at each point in space in steady-state fluid flow is constant, how can a fluid particle accelerate?

13-3 Whenever possible, airplanes take off and land heading into the wind. Why?

13-4 Does the "lift" of an airplane wing depend on altitude?

13-5 How does a baseball pitcher give the ball the spin that makes it curve? Can he make it curve in either direction? Does it matter whether he is righthanded or left-handed? What is a spitball? Why is it illegal?

13-6 When a car on a highway is passed by a large truck,

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13-7 In a store-wind
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Problems

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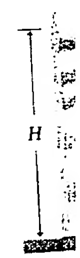

13-3 A cylin
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